GOES Solar X-Ray Imager

RESTful Web API

Version 1.0

Last Updated: April 2012

INTRODUCTION

The GOES SXI RESTful API is a web service that allows users to download SXI images from NOAA/NGDC's data archive using an HTTP request. Users can search through the archive, the data of their interest through variety of data parameters. Data parameters include the **Satellite Number**, **Product type** which indicates processed or unprocessed images, **format** of the image like FITS or PNG, **Image type** which specifies what solar phenomenon has been targeted by the exposure parameters, **wavelength** which indicates the filter mnemonic, the **exposure time** and the **time period** of data download. The web service response contains a bunch of URLs that point to the SXI images. Users can choose to view the images, download a copy to their local machine or process the images using external software. The response is returned in the format specified by the users while constructing the HTTP request URL. The supported response formats include XML, JSON (JavaScript Object Notation), Text and HTML. The HTTP request URL works well in a browser, on a command line and in a program code.

AUDIENCE

This document is intended for GOES SXI data users who want to use SXI images for their research and study. It provides an introduction to using the API, describes the various data request parameters and response formats supported along with bunch of examples. This document assumes that the reader is familiar with RESTful Web service and Hypertext Transfer Protocol (HTTP) technology.

SXI Requests

A typical GOES SXI service request URL is of the following form:

http://www.ngdc.noaa.gov/goes/sxi/getImageURL/**goes_satellite_number**/**product_type**.**output**?**parameters**

where,

goes_satellite_number indicates the satellite number. This service provides access to the following GOES Satellite data: GOES-12, GOES-13, GOES-14, and GOES-15.

Example:

- goes12
- goes13

product_type indicates the level of the products. It may be either of the following values:

- level0 - Unprocessed (Level-0) images are raw and uncalibrated
- level1 - Processed (Level-1) images have been calibrated, rotated, etc

output indicates the response format. It may be either of the following values:

- html - generates output in an HTML page (Default)
- xml - generates output in XML format
- txt - generates output in Text format
- json - generates output in JSON (JavaScript Object Notation) format

Data Request Parameters

Few of the parameters are required while the others are optional. The parameters are separated by ampersand (&) in the request URL.

- **fromDate** (Required) - Defines the start date from which to obtain data. It is represented by the following date format: yyyyMMddHHmmss

  Eg: 20110201001213

- **toDate** (Required) - Defines the end date from which to obtain data. It is represented by the following date format: yyyyMMddHHmmss

  Eg: 20110201231259

  NOTE: Please limit to 12 months of data download.

- **imgFormat** (Required) - Response format of the images.

  It may be either of the following values:

  - fts - for FITS format
  - png - for PNG format

- **imgType** (Optional) - Indicates what solar phenomenon has been targeted by the exposure parameters. Image type values differ depending on the satellite number and the level of products. Click on the links below to see valid Image type values for each satellite.

  GOES-12 GOES-13 GOES-14 GOES-15

- **wavelength** (Optional) - Indicates the filter mnemonic. Wavelength values depend on the Image type values. Click on the links above to view valid wavelength values for a particular satellite, product level and Image type.

- **fromExpTime** (Optional) - Defines the Exposure time which is the actual image integration time in seconds. Valid range: 0.0 - 20.0

- **toExpTime** (Optional) -Defines the Exposure time which is the actual image integration time in seconds. Valid range: 0.0 - 20.0

NOTE: Omitting the Optional parameters from the Request URL returns SXI images of all Image types, wavelength and exposure times. The use of Optional parameters refines your search for SXI images.

SXI Responses

The response formats are indicated by the ***output*** flag in the request URL.

http://www.ngdc.noaa.gov/goes/sxi/getImageURL/**goes_satellite_number**/**product_type**.**output**?**parameters**

Format	How to Specify	Description
HTML/HTM	default	Displays the output in an HTML page.
XML	xml	Displays the output in XML format.
JSON	json	Displays the output in JSON (JavaScript Object Notation) format.
Text	txt	Returns a text file with the requested data

HTML Output

HTML is the default response format.

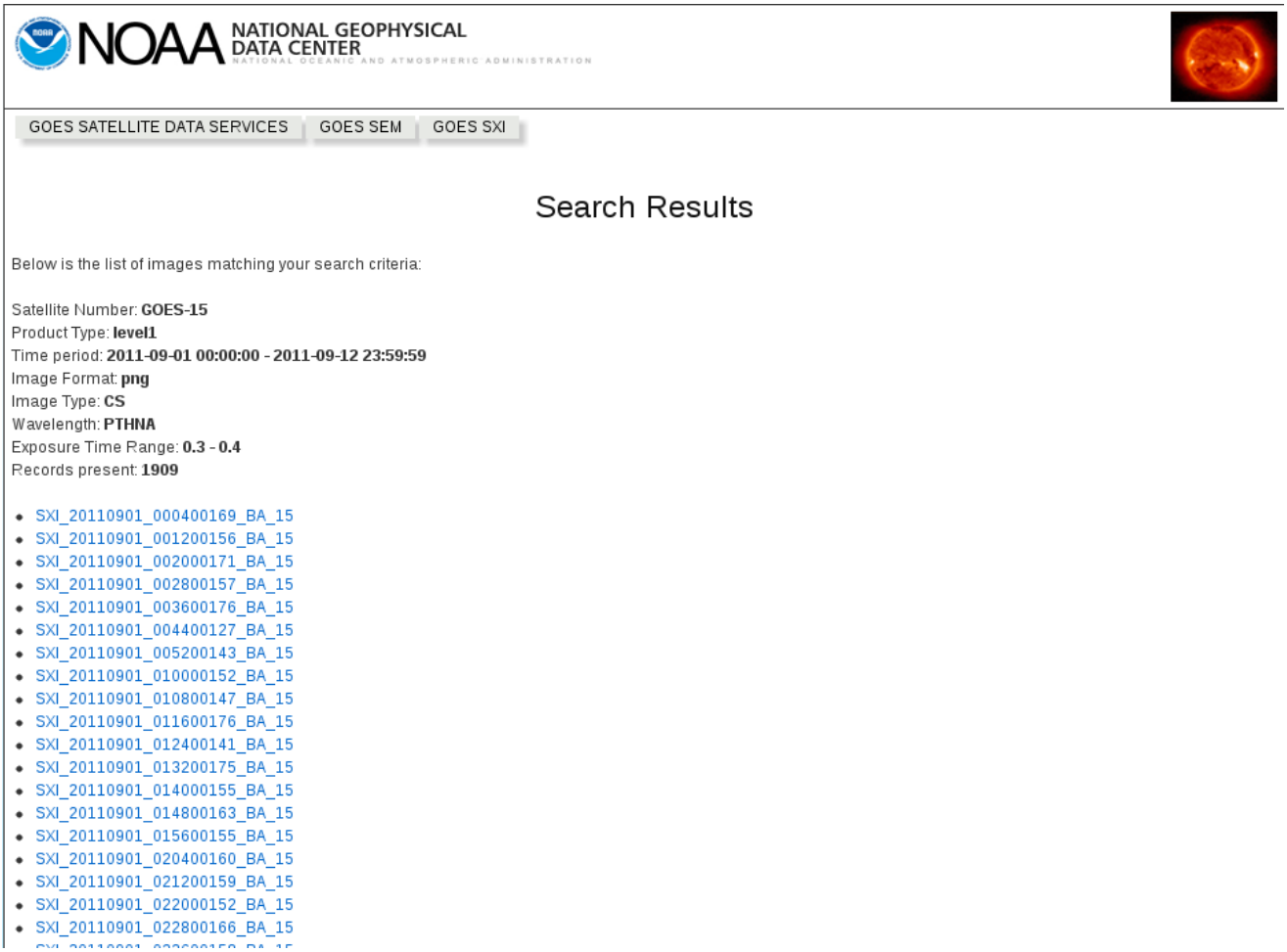
A sample HTTP request is shown below for the following search criteria:

- Satellite Number: GOES-15
- Product Type: Level 1
- Time period: 2011-09-01 00:00:00 - 2011-09-12 23:59:59
- Image Format: png
- Image Type: CS
- Wavelength: PTHNA
- Exposure Time Range: 0.3 - 0.4

Request URL:

http://www.ngdc.noaa.gov/goes/sxi/getImageURL/goes15/level1.**html**?fromDate=20110901000000&toDate=20110912235959&imgFormat=png&imgType=CS&wavelength=PTHNA&fromExpTime=0.3&toExpTime=0.4

The above request generates an HTML page (like below) that lists links to the requested SXI images and contains the number of records returned.



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Search Results

Below is the list of images matching your search criteria:

Satellite Number: **GOES-15**
Product Type: **level1**
Time period: **2011-09-01 00:00:00 - 2011-09-12 23:59:59**
Image Format: **png**
Image Type: **CS**
Wavelength: **PTHNA**
Exposure Time Range: **0.3 - 0.4**
Records present: **1909**

- SXI_20110901_000400169_BA_15
- SXI_20110901_001200156_BA_15
- SXI_20110901_002000171_BA_15
- SXI_20110901_002800157_BA_15
- SXI_20110901_003600176_BA_15
- SXI_20110901_004400127_BA_15
- SXI_20110901_005200143_BA_15
- SXI_20110901_010000152_BA_15
- SXI_20110901_010800147_BA_15
- SXI_20110901_011600176_BA_15
- SXI_20110901_012400141_BA_15
- SXI_20110901_013200175_BA_15
- SXI_20110901_014000155_BA_15
- SXI_20110901_014800163_BA_15
- SXI_20110901_015600155_BA_15
- SXI_20110901_020400160_BA_15
- SXI_20110901_021200159_BA_15
- SXI_20110901_022000152_BA_15
- SXI_20110901_022800166_BA_15

Text Output

Request URL:

http://www.ngdc.noaa.gov/goes/sxi/getImageURL/goes15/level1.**txt**?fromDate=20110901000000&toDate=20110912235959&imgFormat=png&imgType=CS&wavelength=PTHNA&fromExpTime=0.3&toExpTime=0.4

The above request wraps the output data in a Text file and returns the file to the user. The requestor can then choose to view the created file or save a copy of the file to their local machine.

The generated text file looks like below.

```
Records present:1909
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_000400169_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_001200156_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_002000171_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_002800157_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_003600176_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_004400127_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_005200143_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_010000152_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_010800147_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_011600176_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_012400141_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_013200175_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_014000155_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_014800163_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_015600155_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_020400160_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_021200159_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_022000152_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_022800166_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_023600158_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_024400163_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_025200159_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_030000137_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_030800170_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_031600147_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_032400182_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_033200165_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_034000173_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_034800152_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_035600143_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_040400168_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_041200159_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_042000173_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_042800130_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_043600159_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_044400142_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_045200138_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_050000185_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_050800163_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_051600162_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_052400146_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_053200166_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_062000162_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_062800153_BA_15.PNG
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_063600182_BA_15.PNG
```

JSON Output

The HTTP request for the identical query in JSON format is shown below.

Request URL:

http://www.ngdc.noaa.gov/goes/sxi/getImageURL/goes15/level1.**json**?fromDate=20110901000000&toDate=20110912235959&imgFormat=png&imgType=CS&wavelength=PTHNA&fromExpTime=0.3&toExpTime=0.4

For more info on JSON.

The response is returned in a JSON format. In the response below, few repeated elements has been removed for clarity.

```
{
    results: [
"http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_000400169_BA_15.PNG"
"http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901_001200156_BA_15.PNG"
          … additional elements
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/12/SXI_20110912_234800155_BA_15.PNG
"http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/12/SXI_20110912_235600171_BA_15.PNG"
      ]
    response_status: "OK"
    records_present: 1909
}
```

Elements in the JSON response explained.

- The "***results***" array contains the URLs of the SXI images.
- The "***response_status***" object contains the status of the request. See below for detailed information.
- The "***records_present***" object contains the number of the records returned for the request submitted.

XML Output

The HTTP request for the identical query in XML format is shown below.

Request URL:

http://www.ngdc.noaa.gov/goes/sxi/getImageURL/goes15/level1.**xml**?fromDate=20110901000000&toDate=20110912235959&imgFormat=png&imgType=CS&wavelength=PTHNA&fromExpTime=0.3&toExpTime=0.4

The response is returned in a XML format. In the response below, few repeated elements has been removed for clarity.

```
<response>
<response_status>OK</response_status>
<records_present>1909</records_present>
<results>
<imageURL>
```

```
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901
_000400169_BA_15.PNG</imageURL>
<imageURL>
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/01/SXI_20110901
_001200156_BA_15.PNG</imageURL>
… additional <imageURL> elements
<imageURL>
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/12/SXI_20110912
_234800155_BA_15.PNG
</imageURL>
<imageURL>
http://satdat.ngdc.noaa.gov/sxi/archive/browse/goes15/2011/09/12/SXI_20110912
_235600171_BA_15.PNG
</imageURL>
</results>
</response>
```

The XML response is wrapped in the root element ***<response>.***

<response> sub-elements:

- ***<response_status>*** - contains the status of the request. See below for detailed information.
- ***<records_present>*** - contains the number of records returned as a result of processing the query.
- ***<imageURL>*** - contains the URLs of the SXI images requested.

Response Status Codes

The status of the request is returned in the ***response_status*** field within the response object. It may be either of the following values:

- **OK -** indicates that the request was processed successfully and response contains valid results. In this case, the ***records_present*** field contains the number of records returned.
- **No_Data_Found -** indicates that the request was processed successfully, but no data was returned.

In case of invalid request, the ***response_status*** field indicates the reason for the error.

Debugging the error responses

The error messages may be one of the following:

- Error: Invalid Dates. Please verify the **fromDate** and **toDate** parameters – In the this case, check the following:
    - Are both the parameters fromDate and toDate present?
    - Do they follow the format – yyyyMMddHHmmss?
    - Are the specified dates' valid ones?

    - There is a download limit which is 12 months. Check if the difference between fromDate and toDate is within 12 months. If not, that's the cause of the error.
- Error: Invalid **Image Format** – The imgFormat parameter may contain either of the following values.

    - fts - for FITS format
    - png - for PNG format

    If the parameter contains any value other than the ones specified above, this error is thrown.

- Error: Either one of these is invalid: Image Type or Wavelength. Please verify the corresponding parameter values – This error occurs when any one of the **imgType** and **wavelength** parameters is invalid. In this case, first check the **imgType** value to see if it's a valid one for the satellite number specified. If true, check the **wavelength** parameter value to see if it's valid for the **imgType** value specified.
- Error: Invalid Exposure Time. Please verify the **fromExpTime** and **toExpTime** parameters – Check if the fromExpTime and toExpTime parameters' values range is between 0.0 and 20.0. If not, the above error is thrown.
- Error: The Satellite Number specified in the URL is invalid – The satellite number is specified by the following format: **goesxx**. Check the system home page to see what satellite's data the system currently supports.
- Error: The Product type specified in the URL is invalid – The **product_type** parameter may contain either of the following values.
    - level0 - Unprocessed (Level-0) images are raw and uncalibrated
    - level1 - Processed (Level-1) images have been calibrated, rotated, etc
- Error: Either one or all of the required input parameters (fromDate,toDate,imgFormat) are missing – Check if the request URL contains the required parameters: fromDate, toDate and imgFormat.